



**KAD
INSTRUMENT
RENTAL**

**901 ELMGROVE ROAD
ROCHESTER, N.Y. 14650**

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INSTRUCTIONS

**POOL EQUIPMENT
CALIBRATION SERVICES
PHONE 64262**

Models 750A, AR, D & DR GAUSSMETERS

RFL Industries, Inc.
Boonton, New Jersey U.S.A.

INSTRUCTIONS

Models 750A, AR, D & DR GAUSSMETERS

For units with Serial Numbers above 1081



1976

RFL Industries, Inc.

Book No. MA-41960A



Model 750A Gaussmeter, with analog indicator.



Model 750D Gaussmeter, with digital indicator.



WARNING:

The Equipment Herein Described Contains High Voltage

Exercise due care during operation and servicing.
Read safety summary on reverse of this page.

SAFETY SUMMARY

The following safety precautions must be observed at all times during operation, service, and repair of this product. Failure to comply with these precautions, or with specific warnings elsewhere in this manual violates safety standards of design, manufacture, and intended use of the product. RFL assumes no liability for failure to comply with these requirements.

GROUND THE EQUIPMENT

To minimize shock hazard, chassis, cabinets, and equipment racks must be connected to an electrical ground. AC powered products should be equipped with a three-conductor power cable, or equivalent connection on a terminal block. Power cables must either be plugged into an approved three-contact electrical outlet or used with a three-contact or two-contact adapter with the grounding wire (green) firmly connected to an electrical ground (safety ground) at the power outlet. The power jack and mating plug of power cables provided meet International Electrotechnical Commission (IEC) safety standards. Equipment provided with terminal blocks, operating from either ac or dc, is provided with appropriate means for connecting an electrical safety ground.

DO NOT OPERATE IN AN EXPLOSIVE ATMOSPHERE

Do not operate the product in the presence of flammable gases or fumes. Operation of any electrical equipment in such an environment constitutes a definite safety hazard.

DO NOT OPERATE IN WET OR DAMP AREAS

Do not operate the product in wet or damp areas. Operation of any electrical equipment in such an environment constitutes a definite safety hazard.

KEEP AWAY FROM LIVE CIRCUITS

Operating personnel must not remove covers. Replacement of components and internal adjustments must be made by qualified maintenance persons. Disconnect power cable when replacing components. Under certain conditions, dangerous voltages may exist even with the power cable removed. To avoid injuries always disconnect power and discharge circuits by grounding before touching them.

DO NOT SERVICE OR ADJUST ALONE

Do not attempt internal service or adjustment unless another person capable of rendering first aid and resuscitation is present.

DO NOT SUBSTITUTE PARTS OR MODIFY EQUIPMENT

Because of the danger of introducing additional hazards, do not install substitute parts or perform an unauthorized modification to the equipment. The product may be returned to RFL for service and repair to ensure that safety features are maintained.

DANGEROUS-PROCEDURE WARNINGS

Throughout this manual, warnings identify potentially dangerous procedures. Instructions contained therein must be followed.

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SPECIFICATIONS

MODEL 750A

Accuracy: $\pm 1.5\%$ of full-scale range, plus probe accuracy to 10 kG direct reading. Probe data supplied for fields to 25 kG. Special probe data available for fields above 25 kG.

Low Ranges: 0 to 0.1, 0.2, 0.5, 1, 2, 5, 10, 20, 50 Gauss Full Scale.

High Ranges: 0 to 100, 200, 500, 1K, 2K, 5K, 10K, 20K, 50K Gauss Full Scale.

Frequency Response: (Typical)

fHz	Attenuation dB
20	0
100	— .02
150	— .05
200	— .09
300	— .25
400	— .52
500	—1.0
600	—1.9
700	—3.4
800	—4.8

AC measurements are in terms of peak flux density.

MODEL 750D

Accuracy: $\pm[0.2\%$ of reading ± 1 digit], plus probe accuracy to 10 kG direct reading. Probe data supplied for fields to 25 kG. Special probe data available for fields above 25 kG.

Ranges: 0 to 10, 100, 1K, 10K, and 100K full-scale, plus 100% overrange.

Frequency Response: (Typical)

fHz	Attenuation dB
20	0
100	— .02
150	— .05
200	— .09
300	— .25
400	— .52
500	—1.0
600	—1.9
700	—3.4
800	—4.8

AC measurements are in terms of peak flux density.

Temperature Effects:

Instrument: Normal temperature excursions encountered in laboratory or typical production facility will have little or no effect on the instrument's operation or accuracy.

Probe: Standard InAs element Hall probes will generally exhibit a temperature coefficient of approximately $-0.1\%/^{\circ}\text{C}$. Probes for the Model 750A and 750D will have temperature coefficients no greater than $0.1\%/^{\circ}\text{C}$. Typical values will be on the order of -0.06% to $-0.08\%/^{\circ}\text{C}$.

Temperature compensated probes are available on special order with a zero drift of less than ± 0.1 Gauss/ $^{\circ}\text{C}$.

DESCRIPTION

RFL Model 750 Series Gaussmeters are supplied as a Model 750A analog version, Model 750D digital-display instrument, or as Model 750AR or 750DR which are rack-mount versions of the standard instruments.

Models 750A and 750D are bench-mount instruments equipped with a carrying handle, zero-Gauss chamber, and incorporating a storage area for the Hall probe. All operational controls are located on the front panel. Rear panel connectors provide a 0 to 1.5 volt dc emf proportional to the full-scale range of the meter, and a separate output to enable visual display of the magnetic field effects on an auxiliary oscilloscope.

Internal calibration is provided in all instruments. The electronic calibration circuit is adjusted at the factory with instrumentation having an accuracy of better than 0.1%. Traceability to the National Bureau of Standards is assured through instrumentation checked by NBS or having basic values obtainable through standard physics technology.

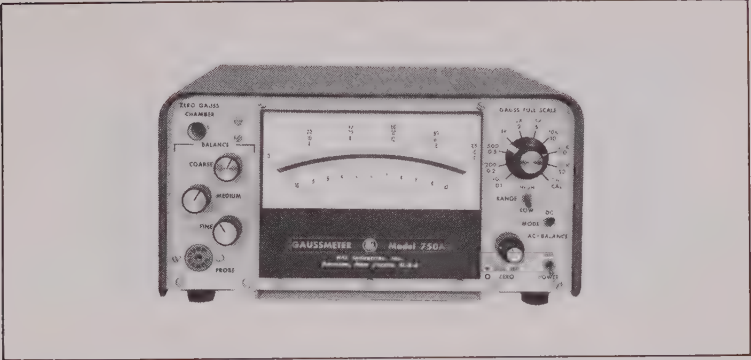
Model 750A

The analog instrument measures dc and permanent magnet fields and ac fields to 600 Hz at flux density levels up to 50,000 Gauss. Eighteen full-scale ranges are provided using a 1 — 2 — 5 scaling arrangement with 0.1 Gauss full-scale as the most sensitive range. A 5½ inch parallax corrected taut-band meter with 100 divisions provides readout to tenths of a scale division. A zero center scale is also provided to enhance operation when polarity indication is desired.

Model 750D

The Model 750D is similar in appearance and operation to the Model 750A. A 3½ digit seven segment display is incorporated providing a full four digits at full-scale range. One hundred percent overrange is provided as well as polarity indication of the field being measured. Bipolar circuitry and meter indication simplify operation where fields of alternate polarity are measured. Five full-scale ranges of 10, 100, 1000, 10,000, and 100,000 Gauss are incorporated into the Model 750D allowing resolution of 0.01 Gauss on the most sensitive range. Decimal point location for the various ranges is automatic through operation of the RANGE selector.

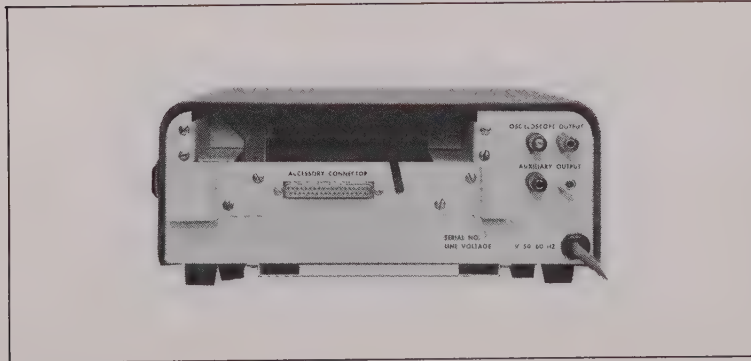
Operation of all units is from 115 or 230 volt, 50/60 Hz, 10 watts, line supply. Instrument size is 11½ inches (29 cm) wide over handle, 6½ inches (16.5 cm) high and 10 inches (25 cm) deep. Weight is 7 pounds (3.3 kg) for the Model 750A and 8 pounds (3.6 kg) for the Model 750D.



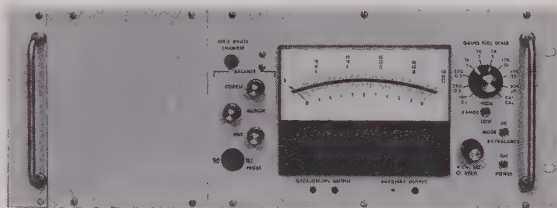
Front-panel detail, Model 750A.



Front-panel detail, Model 750D.



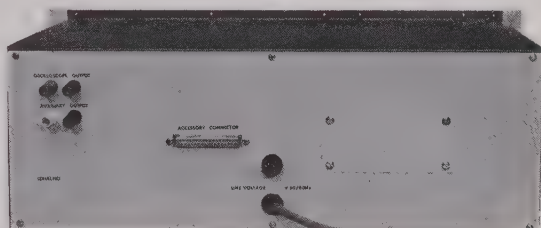
Rear-panel detail, Models 750A and 750D.



Front-panel detail, Model 750AR.



Front-panel detail, Model 750DR.



Rear-panel detail, Models 750AR and 750DR.

The 750AR and 750DR are rack mount versions of the bench instruments and incorporate all the attributes of their counterparts. In these instruments the auxiliary outputs are available from the front panel, and at the rear. The rack style enclosure also incorporates space to install the ID-75 Incremental/Differential Module. The R versions occupy 7 inches of rack height with a standard 19 inch rack width panel.

Both the Model 750A and the Model 750D are equipped with a 37-pin EIA connector for quick connection to the Model ID-75 Incremental/Differential Adapter. The connector also carries the 1.5 volt, full-scale analog signal. The mating plug for this connector, RFL P/N HB-43774, may be ordered separately, and is listed on the price list.

When Option HB-43775, for BCD output, is ordered, the mating plug is included. The mating plug is also part of the cable assembly supplied with the Model ID-75, and BCD wiring can be added to this cable assembly by the buyer if so desired.

Internal wiring of the Model 750D for BCD output can be performed at the factory or in the field. A wiring list is included on page 27. A wiring harness for the BCD option can be ordered from the factory as RFL P/N HB-43773, and the mating plug should be ordered with the harness.

BCD output is a 1 2 4 8 code, using positive logic, with standard TTL levels of 0.4 volts max. and 2.4 volts min. for 0 and 1, respectively. The drive will sink two standard loads, 3.2 mA in the low state.

OPERATING INSTRUCTIONS

1. Check line voltage marking on rear of instrument to be certain unit is set for proper line voltage. To change line voltage consult instructions at end of section on Calibration.
2. Adjust all three BALANCE controls to the center of their rotation (each control is a ten-turn potentiometer).
3. Set CAL control to the center of its rotation (this control is a single-turn potentiometer).
4. For Model 750A set ZERO control to the center of its rotation (single turn potentiometer).
5. Set GAUSS FULL SCALE RANGE selector to 100K on the Model 750D. On the Model 750A place RANGE switch in HIGH and GAUSS FULL SCALE RANGE selector on 50K Gauss.
6. Remove Hall probe container from rear of instrument enclosure (on rack mount instruments the probe container is not incorporated into the enclosure). Remove probe from its container and plug it into the Gaussmeter PROBE receptacle.
7. Plug Gaussmeter line plug into appropriate ac line power receptacle.
8. Place sensing end of Gaussmeter probe into the ZERO GAUSS CHAMBER. Set MODE switch to AC/BALANCE and POWER switch to ON. On the Model 750D the DPM segments will light, indication should be 00.0. On the Model 750A the meter ZERO control should be adjusted, if necessary for 0 indication on upper scale.
9. Allow about three minutes for instrument warm-up.
10. Set RANGE selector to 10K and adjust MEDIUM BALANCE control for meter zero indication.

Set RANGE selector to 1K and again adjust MEDIUM BALANCE control for meter zero. If zero is not attainable adjust both COARSE and MEDIUM BALANCE controls until zero is achieved.

11. Set RANGE selector to 10 Gauss position and adjust COARSE, MEDIUM, and FINE BALANCE controls until a minimum reading is achieved. On Model 750A the RANGE switch must also be placed in LOW position and the RANGE selector placed in 0.1 position after minimum indication is achieved on the 10 Gauss range. **Note:** There will be some interaction between the controls.
12. Set MODE switch to DC and adjust FINE BALANCE control only for a meter reading of zero. On the Model 750D a reading of either 0.00 or -0.00 is correct.
13. **Model 750A only:** Set RANGE selector to 50K, RANGE switch to HIGH, and check for zero indication of meter on upper scale. Adjust ZERO control if necessary for zero meter indication. Return RANGE selector to 0.1 and RANGE switch to LOW and readjust FINE BALANCE control for meter zero indication.
14. Place RANGE switch in CAL position. Adjust CAL control until meter on Model 750A indicates full-scale. **Note:** Two extra pickets are marked beyond the full-scale cardinal picket. On Model 750D adjust CAL control until DPM indicates 1.000.
15. Place RANGE selector (and RANGE switch on the Model 750A) to settings appropriate for the measurements which will be performed. Remove probe from ZERO GAUSS CHAMBER.

NOTE: The probe tip is color coded for polarity indication purposes. When the side colored red is facing a magnetic pole which would attract the north seeking end of a compass needle the meter will deflect up-scale (to the right) on the Model 750A. The Model 750D DPM will indicate a reading with no polarity sign before the numerals.

16. In many instances it is advisable to periodically recheck the Gauss-meter calibration and zero condition. For calibration check merely place the RANGE selector in CAL position and note meter indication. It is not necessary to remove the probe tip from the field being measured for this check.

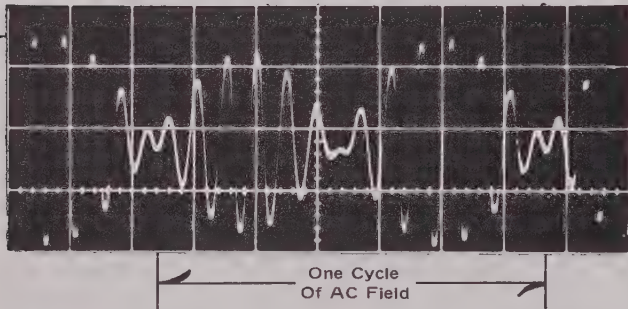
To check zero balance place probe tip in the ZERO GAUSS CHAMBER and observe steps 4, 5, and 6 above if zero indication is not in evidence. If measurements are not of a high order of accuracy any slight change in zero will not affect the readings. Under normal conditions resetting of the BALANCE or CAL controls may only be required once a day.

Polarity Sensing

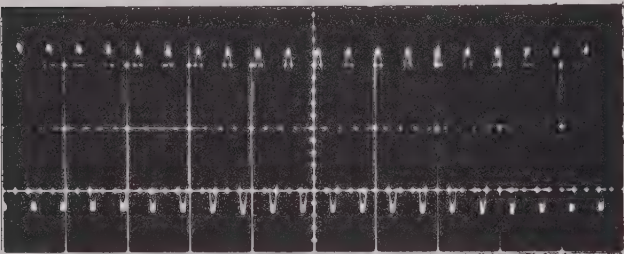
In DC Mode the Models 750A and 750D are polarity sensitive. The Model 750D incorporates a bipolar meter which automatically indicates field polarity.

In AC Mode, the Gaussmeter will measure the peak value of a sinusoidally varying magnetic field which has no dc component.

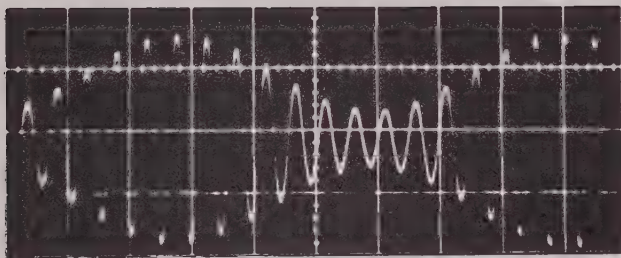
The following waveforms can be observed with an oscilloscope connected to the output terminals:



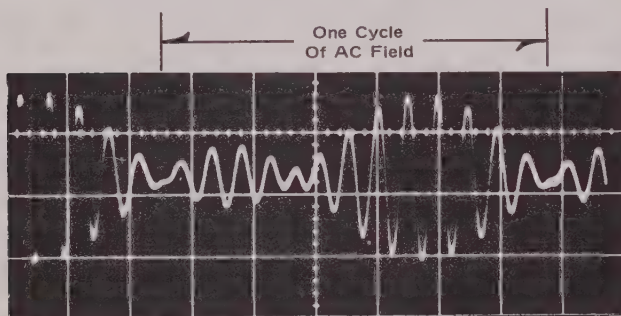
Oscilloscope output with ac field. Meter will read peak value of field in ac mode. Carrier frequency is approximately 1 kHz.



Oscilloscope output with dc field. Meter will read 1.57 times dc field in ac mode.



Oscilloscope output with ac and dc fields. Peak ac field is less than dc field. Meter will read 1.57 times dc field in ac mode.



Oscilloscope output with ac and dc fields. Peak ac field is greater than dc field.

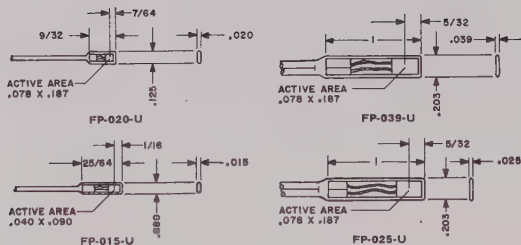
Model 750A Only

Zero-center operation. After completing step 7, foregoing, set the RANGE selector to 50K and the RANGE switch to HIGH and adjust the Gaussmeter ZERO control until 0 indication on the lower (zero center) scale is achieved. This scale is calibrated 10 — 0 — 10. Thus on a range having a scale factor of 1, for example the 10-Gauss range, end scale readings would be 5 Gauss. On the 50 Gauss range end scale indication would be 25 Gauss.

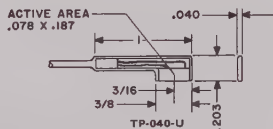
Probe "Turnover" Error

Due to the slight unbalances in Hall elements some degree of turnover is evident in some probes. Turnover is indicated by a difference in readings in a given field when the polarity is reversed. For example, the Model 750D might indicate 85.0 Gauss with the probe in a given field and -85.1 Gauss when the probe is reversed in that field. For highest accuracy make readings of the same polarity as indicated when the RANGE selector is placed in CAL position.

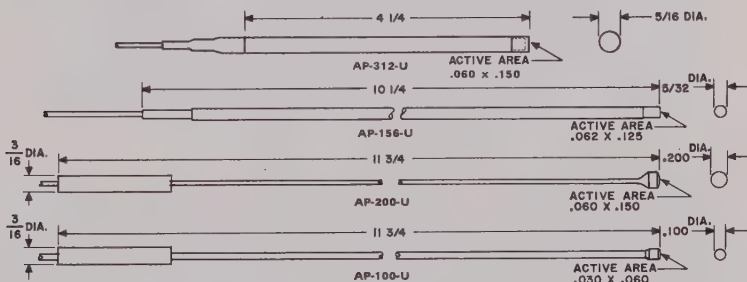
FLAT PROBES



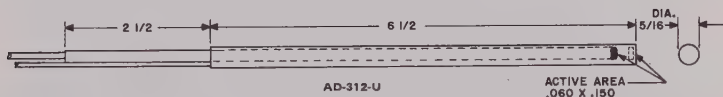
TANGENTIAL PROBE



AXIAL PROBES



DIFFERENTIAL AXIAL PROBE



NOTES:

1. A wide range of probe configurations available for special applications on request.
2. All probes are supplied with a 5 foot cable. Extension cables available.

**TERMINAL FUNCTIONS – ACCESSORY CONNECTOR J1
MODELS 750A and 750D**

TERMINAL	FUNCTION	TERM IN DPM – J3
1	J2 – 3	
2	J2 – 4	
3	J2 – 7	
4	J2 – 6	
5	Probe Balance	
6	Probe Balance	
7	Attenuator Ground	
8	Chassis Ground	
9	Digital and BCD Ground	N
10	BCD 800 Output	9
11	BCD 400 Output	11
12	BCD 200 Output	12
13	BCD 100 Output	K
14	BCD 8 Output	5
15	BCD 4 Output	F
16	BCD 2 Output	6
17	BCD 1 Output	E
18	Hold	D
19	Print Command	3
20	J2 – 1	
21	J2 – 2	
22	J2 – 8	
23	J2 – 9	
24	Analog Output 1.5V Full-Scale	
25	Power Supply Ground	
26	+15V Output	
27	–15V Output	
28	Polarity	4
29	BCD 1000 Output	14
30	BCD 80 Output	7
31	BCD 40 Output	J
32	BCD 20 Output	8
33	BCD 10 Output	4
34		
35		
36		
37	Outrange	C

Terminals of J1 which are associated with J3, in the foregoing, are wired at the factory when Option HB-43773, providing BCD output, is ordered.

THEORY OF OPERATION

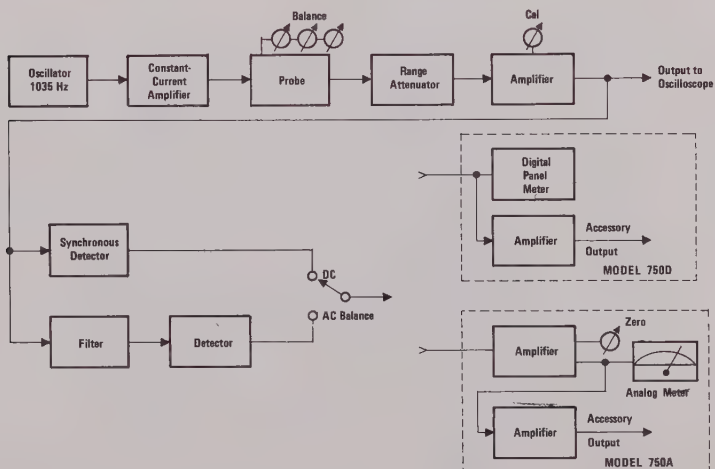
Refer to Block Diagram, Figure 1 and the Hall effect, page 17.

The oscillator generates a constant voltage, near 1035 Hz, which is converted to a constant current for the Hall probe drive. A series of Balance controls is used to compensate for probe element electrical unbalance and for any in-phase and quadrature unbalance in the Gauss-meter electronic circuitry.

The emf generated in the probe by a magnetic field is fed to the Range Attenuator where it is scaled to permit measurements over the various ranges. The following amplifiers raise the Hall emf to a useable value. The Calibration Control and probe level setting resistors are part of the amplifier circuit.

In the AC/BALANCE MODE the signal is filtered to remove oscillator harmonics, and any line-frequency components, and is detected with a precision operational rectifier. In DC MODE the signal is sensed with a synchronous detector providing an output proportional to both amplitude and polarity of the magnetic field.

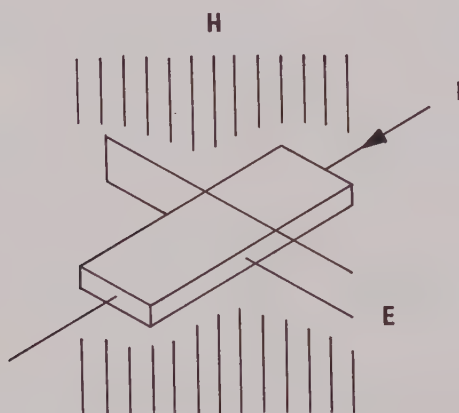
In the Model 750A the output of either the operational rectifier or synchronous detector drives a subsequent amplifier which has a ZERO control to enable either zero left or zero center operation. In the Model 750D the detector output(s) drive the DPM directly.



The Hall Effect

When electrons move in a conductor or semiconductor perpendicular to a magnetic field, they are deflected to one side of the conductor (left or right depending on the polarity of the field) in a direction normal to both the initial electron flow and the magnetic field.

The force deflecting the electrons is directly proportional to the electron velocity (current) and the magnetic field intensity. This deflection process continues until sufficient charge has accumulated at the sides of the conductor (or semiconductor) to establish a transverse electric field which opposes further deflection of charge carriers.



The magnitude of this potential is given by:

$$E = \frac{RIH}{t}$$

where, E is the Hall voltage, I is the current in amperes, H is the magnetic flux density in Gauss, t is thickness in cm and R is the Hall coefficient.

CALIBRATION PROCEDURES

General: Under conditions of ordinary use, it is recommended that the zero and full-scale points of the Models 750A and 750D be checked daily, as a minimum. When working with low-level fields, it may be advisable to check the zero more frequently. These adjustments are described in the "Operational Instructions" of this manual.

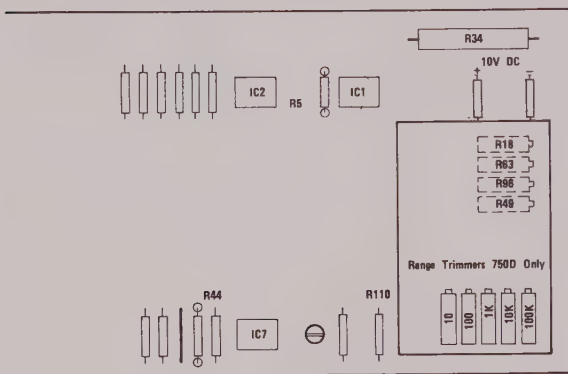
Test Equipment: For more extensive adjustments, the following test equipment is recommended:

- a. A digital ac and dc voltmeter, with six-digit readout, and with dc ranges of 0.1, 1.0, 10, and 100 volts full-scale, $\pm 0.02\%$; ac ranges of 1.0, 10, and 100 volts, full-scale, $\pm 0.25\%$.
- b. An oscilloscope with vertical response of at least 1 MHz ± 3 dB, sensitivity of at least 1 mV per cm, and with commensurate horizontal time base.
- c. A frequency counter with capability to several kHz, and with sensitivity ranges of 0.1, 1.0, and 10 volts.
- d. A resistance decade with resolution of 0.1 ohm and with maximum resistance of at least 10K ohms.
- e. Reference magnets with fields of 10, 50, 100, 200, 500, 1000, 5000, 10,000 and 20,000 Gauss. Accuracy of reference magnets affects accuracy of calibration.
- f. A precision solenoid, or Helmholtz coil, with a range of at least 0.1 to 20 Gauss.
- g. An ac reference magnet with a field of 1000 Gauss. Accuracy of reference magnet affects accuracy of calibration.

Oscillator Adjustment: This adjustment may be necessary if components of the oscillator circuit are replaced. It is accomplished as follows:

1. Insert standard FP-039/U Probe into Probe Socket.
2. Connect dc voltmeter between TP-17 (high) and TP-12 (ground). Adjust R21 until voltmeter reads $+7.500 \pm 0.1\%$ volts.
3. Connect frequency counter between TP-10 (high) and TP-12 (ground), and adjust R1 for frequency of 1035 ± 3 Hz.

4. Connect ac voltmeter between TP-10 (high) and TP-12 (ground), and adjust R67 until voltmeter reads $5.600 \pm 0.01\%$ volts.
5. Connect ac voltmeter between TP-11 (high) and TP-12 (ground), and adjust R115 until voltmeter reads $5.600 \pm 0.01\%$ volts.



Location of Adjustments, Models 750A and 750D.

Amplifier Offset Adjustment

1. Place jumper from H to G.
2. Connect dc voltmeter between TP-16 (high) and TP-15 (ground).
3. Set MODE switch on front panel to AC/BALANCE.
4. Adjust R63 for zero reading on dc voltmeter.
5. Set MODE switch on front panel to DC.
6. Adjust R96 for zero reading on dc voltmeter.
7. Place jumper back from G to H.

Meter Amplifier Adjustment (Model 750A)

1. Connect a digital voltmeter between TP-14 (high) and TP-12 (low). Set the range to 0.1 Vdc. Turn power ON.
2. Adjust the outer ring of the ZERO ADJUST control until the voltmeter indicates zero. The panel meter should also indicate zero, at the left end of the scale. Next, adjust the ring until the panel meter indicates zero-center. Then readjust the control until zero-left is again obtained.
3. Set the voltmeter to the 1.0 Vdc range. Set the Gaussmeter range switch to CAL. Adjust CAL SET control for a voltmeter reading of 1.00 volt. Adjust R87 for a full-scale panel meter reading.

HIGH-LOW Calibration, Model 750A

1. Select a Hall probe which has been calibrated, plug it into the PROBE socket, and place it in the ZERO GAUSS CHAMBER. Zero the probe, following steps 1 through 7 in operating instructions.
2. Adjust the digital voltmeter to the 10 Vdc range, and connect it between TP-14 (high) and TP-12 (low).
3. Turn Gaussmeter ON, RANGE switch to HIGH, RANGE SELECTOR to 50K. Adjust ZERO until both digital voltmeter and panel meter indicate zero.
4. Place probe in the 50-Gauss reference magnet. Adjust CAL control until the panel meter indicates full-scale. Place MODE switch at AC/BALANCE and adjust CAL control until the digital voltmeter indicates 1.571 volts.
5. Place MODE switch in DC position, and adjust R49 until the digital voltmeter indicates 1.000 volt.
6. Place RANGE switch to HIGH, RANGE SELECTOR to 1K. Place probe in the 1000-Gauss reference magnet. Adjust R210, on the attenuator board until the voltmeter indicates 1.000 volt.

Range-Calibration Check, Model 750A

1. Check each range using a precision solenoid or a Helmholtz coil for the ranges from 0.1 through 20 Gauss. Use reference magnets for higher ranges. The 20,000-Gauss magnet may be used for the 50,000-Gauss range. Probe correction data should be used where necessary.
2. Check scale distribution on the 1000-Gauss range. Use magnets of 1000, 500, 200, 100, and 50 Gauss.
3. Using the 2000-Gauss range, check scale distribution of the zero-center scale using reference magnets of 1000, 500, and 200 Gauss. Reverse the position of the probe in the magnet to obtain indications at reversed polarity.
4. With the probe in a 1000-Gauss field, and with the Gaussmeter set on the 1000 Gauss range, check the auxiliary output for 1.5 volts output, using a digital voltmeter.
5. Connect an oscilloscope across the OSCILLOSCOPE output. Check the output when the probe is placed in an ac reference magnet, using the 1000-Gauss range. Typical oscillograms are shown on pages 11 and 12.

Range-Trimmed Adjustments, Model 750D

1. Select a Hall probe which has been calibrated, plug it into the PROBE socket, and place it in the ZERO GAUSS CHAMBER. Zero the probe, following the procedures in Steps 1 through 7 in the OPERATING INSTRUCTIONS.
2. Set RANGE switch to 1K. Place probe into 1K reference magnet so that polarity indication of meter is possible. Adjust R115 until meter reads exact value of reference magnet.
3. Place the probe in the ZERO GAUSS CHAMBER and balance the Gaussmeter for minimum reading. Connect the digital voltmeter, set for dc, across TP-16 (high) and TP-15 (ground).
4. Set RANGE to 1K. Place probe in 1000-Gauss reference magnet. Voltmeter should read approximately 1.000 volt. Allow probe to remain undisturbed in reference magnet until the voltmeter reading is stable. Note the reading. DO NOT DISTURB THE PROBE.

5. Set range to 10K. Note voltmeter reading. It should be approximately one tenth of the reading obtained in the foregoing Step 4. Adjust the 10K range trimmer R315 until the reading is precisely one tenth that obtained in Step 4. Repeat Steps 4 and 5 until the ratio of ten between the two ranges is achieved within the accuracy of the voltmeter.
6. With RANGE in 10K position, place probe in 10,000-Gauss reference magnet. Voltmeter should indicate approximately 1.000 volt. Leave probe undisturbed. When voltmeter stabilizes, note reading. Switch RANGE to 100K. Voltmeter should indicate one tenth of previous reading. Adjust 100K range trimmer R316 until voltmeter indicates precisely one tenth of previous reading. Switch RANGE selector back and forth between 10K and 100K to be sure stability of the adjustment has been obtained.
7. Check zero with probe in ZERO GAUSS CHAMBER. Set range to 1K and place probe in a 200-Gauss reference magnet. Voltmeter should indicate approximately 0.20000 volts. When reading has stabilized, switch RANGE to 100 Gauss. The voltmeter now should read approximately two volts. Adjust the 100-Gauss-range trimmer R313 until the reading at the 100-Gauss position is exactly ten times that with the range set to 1K. In all cases, the probe must not be disturbed until the adjustment for the ratio of ten has been completed.
8. Remove probe from reference magnet and recheck zero, using the zero Gauss chamber. Rezero if necessary.
9. Set range at 100 Gauss. Place probe in a field of approximately 20 Gauss. The 50-Gauss reference magnet may be used for this with the probe set so that the voltmeter indicates approximately 0.20000 volt. After stabilizing, note the reading of the voltmeter. Then set range at 10 Gauss. The voltmeter now should indicate approximately ten times the previous reading. Adjust the 10-Gauss trimmer R314 until the voltmeter reads precisely ten times the voltage noted when the range was set at 100 Gauss. Switch back and forth between the 100-Gauss and the 10-Gauss ranges to be certain that stability has been achieved.
10. Recheck all ranges, starting at 10 Gauss
 - a. Probe in field of approximately 20 Gauss. Range at 10 Gauss. Note voltmeter reading.

- b. Set RANGE to 100 Gauss. Voltmeter should read one tenth that obtained on 10 Gauss range.
- c. With RANGE still at 100 Gauss, place probe in 200-Gauss reference magnet. Note reading.
- d. Set RANGE at 1K. Note voltmeter reading. It should be one tenth that noted on 100-Gauss range.
- e. With RANGE at 1K, set probe in a 1000-Gauss reference magnet. Note voltmeter reading.
- f. Set RANGE to 10K. Voltmeter should read one tenth that obtained on 1K range.
- g. With RANGE still at 10K, set probe in a 10,000-Gauss reference magnet. Note voltmeter reading.
- h. Set RANGE at 100K. Voltmeter should read precisely one tenth that noted on 10K range.

This completes the range-trim operation for the Model 750D, and the trimmer-adjustment screws should be sealed.

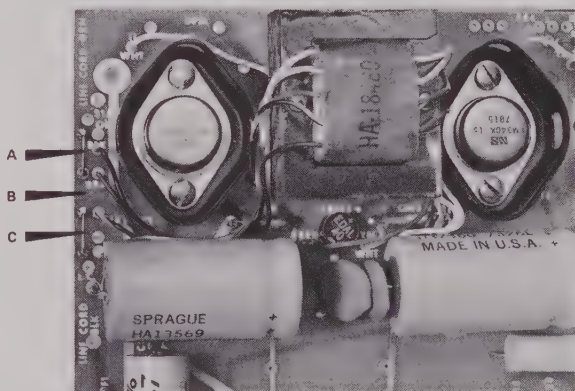
AC/DC Correlation, Model 750D

1. With probe in zero Gauss chamber, adjust zero-balance controls for minimum reading.
2. Set RANGE to 1K; probe in 1000 Gauss reference magnet; MODE to AC/BALANCE. Adjust probe in magnet until Gaussmeter reading is 1.571. Place MODE at DC. Adjust R49 until Model 750D reads 1.000. With voltmeter connected across R34, reset R18 to indicate 5.6 volts.

Changing Primary Power Voltage

Model 750 instruments will operate from either 115— or 230—volt 50-60 Hz ac power. The choice of voltage is made by connecting the dual primaries of the power transformer in either series or parallel. In the case of the Model 750D, the digital panel meter has its own, separate power supply, and its own power transformer using the same arrangement for adjustment to primary voltage available.

In the basic instrument, the connection of the primary of transformer T1 is set by placement of jumpers on the circuit board. The same kind of connection to the primaries of the transformer in the digital panel meter is made by bridging solder across pads on the circuit board.



115-V: JUMPERS AT A AND C, OMIT B
230-V: JUMPER AT B, OMIT A AND C

Primary-Power Connections, Main Circuit Board.

BRIDGE ONE
PAD FOR
230-V
OPERATION
OPEN FOR
115-V



BRIDGE TWO PADS FOR 115-V OPERATION
OPEN PADS FOR 230-V

TROUBLESHOOTING

If the instrument fails to operate, obvious possibilities should be first checked, such as (a) is the line cord plugged in? (b) is there power at the ac receptacle? (c) is there a defective fuse in the instrument? Remember that in the Model 750D there is a separate fuse in the digital panel meter as well as the obvious one on the main circuit board.

After these have been exhausted, set the RANGE switch to CAL, MODE switch to DC, and isolate the problem with the aid of the following table of voltages as a guide. The test points referenced will be found marked on the schematic of the circuit. All measurements are made with respect to circuit common, (TP1).

TABLE 1

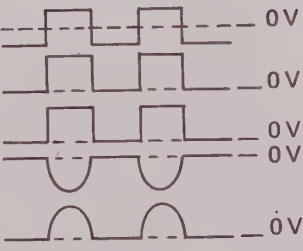
Test Point	Reading	Waveforms
TP 1	25 V p-p	
TP 2	15 V p-p	
TP 3	15 V p-p	
TP 4	4 V p	
TP 5	4 Vp	
TP 10	5.60 V rms	1035 Hz
TP 11	5.60 V rms	
TP 17	7.50 V rms	
Pin 26	+15 V	
Pin 27	-15 V	
TP 13	+1.57 Volts	
TP 7	1.00 Volts	

Table of Replaceable Parts

DIAGRAM SYMBOL	NAME OF PART AND DESCRIPTION	RFL PART NO.
CAPACITORS		
C1	Capacitor, silvered mica, 330pF, 2%, 500V	HA-16624
C2	Capacitor, poly, 0.095 μ F, 2%, 100V	H-5115-82
C3	Capacitor, poly, 0.019 μ F, 2%, 100V	H-5115-48
C4	Capacitor, poly, 0.0785 μ F, 2%, 100V	H-5115-78
C5	Capacitor, dipped mica, 15pF, 5%, 500V	HA-16506
C6	Capacitor, ceramic, 0.47 μ F, +80 -20%, 50V	H-1007-939
C7	Same as C6	
C8	Same as C6	
C9	Same as C6, 2 each in parallel	
C10	Same as C6	
C11	Capacitor, dipped mica, 15pF, 5%, 500V	HA-16506
C12	Same as C6	
C13	Same as C6	
C14	Same as C6, 3 each, in parallel	
C15	Same as C6	
C16	Same as C6	
C17	Same as C6	
C18	Capacitor, poly, 0.027 μ F, 2%, 100V	H-5115-55
C19	Capacitor, poly, 0.0059 μ F, 2%, 100V	H-5115-24

DIAGRAM SYMBOL	NAME OF PART AND DESCRIPTION	RFL PART NO.
C20	Capacitor, poly, 0.012 μ F, 2%, 100V	H-5115-39
C21	Capacitor, poly, 0.47 μ F, 10%, 100V	H-1007-629
C22	Same as C6	
C23	Capacitor, ceramic, 0.47 μ F, +80 -20%, 50V	H-1007-939
C24	Capacitor, mica, 91pF, 5%, 500V	HA-16521
C25	Same as C6	
C26	Same as C6	
C27	Capacitor, film, 1 μ F, 10%, 50V	H-1007-1298
C28	Capacitor, poly, 0.027 μ F, 2%, 100V	H-5115-55
C29	Not used	
C30	Capacitor, tantalum, 6.8 μ F, 20%, 35V	H-1007-655
C31	Capacitor, tantalum, 6.8 μ F, 20%, 35V	H-1007-655
C32	Capacitor, poly, 0.47 μ F, 10%, 400V	H-1007-630
C33 – 100	Not used	
C101	Capacitor, electrolytic, 500 μ F, 50V	HA-13569
C102	Capacitor, electrolytic, 500 μ F, 50V	HA-13569
C103	Capacitor, ceramic disc, 0.1 μ F, 20%, 100V	H-1007-289
C104	Capacitor, ceramic disc, 0.1 μ F, 20%, 100V	H-1007-289
C105	Capacitor, tantalum, 6.8 μ F, 20%, 35V	H-1007-655
C106	Capacitor, tantalum, 6.8 μ F, 20%, 35V	H-1007-655
MISCELLANEOUS COMPONENTS		
F1	Fuse 3/16 A, fast acting (for 230V)	HA-41998

DIAGRAM SYMBOL	NAME OF PART AND DESCRIPTION	RFL PART NO.
F1	Fuse, 3/8 A, fast acting (for 115V)	HA-41999
M1	Meter, gauss, milliammeter (Model 750A)	HA-41994
M1	Meter, digital, panel (Model 750D)	HA-41995
S1	Switch, toggle, DPDT	HA-41996
S2	Switch, toggle, DPDT	HA-41996
SEMICONDUCTORS		
CR1	Diode, silicon, 1N914B	HA-26482
CR2	Same as CR1	
CR3	Diode, zener, 6.2V, 5%, 400mW	HA-8184
CR4	Same as CR1	
CR5	Same as CR1	
CR6	Same as CR1	
CR7	Same as CR1	
CR8	Same as CR1	
CR9	Same as CR1	
CR10	Same as CR1	
CR11	Same as CR1	
CR12	Same as CR1	
CR101	Diode, zener, 6.2V, type 1N5234	HA-29227
CR102	Diode, zener, 6.2V, type 1N5234	HA-29227
CR103	Rectifier, 400V, 1A	HA-26928
IC1	Opamp, LM1458, or eq.	H-0620-51

DIAGRAM SYMBOL	NAME OF PART AND DESCRIPTION	RFL PART NO.
IC2	Opamp, LM1458, or eq.	H-0620-51
IC3	Opamp, LM301, or eq.	H-0620-27
IC4	Opamp, LM1458, or eq.	H-0620-51
IC5	Opamp, LM301, or eq.	H-0620-27
IC6	Not used	
IC7	Opamp, LM1458, or eq.	H-0620-51
IC8	Opamp, LM1458, or eq.	H-0620-51
IC9	Opamp, LM1458, or eq.	H-0620-51
IC10	Analog switch, DG200BA, or eq.	H-0605-3
IC11	Opamp, LM318H, or eq.	H-0620-99
IC12	Opamp, LM1458, or eq.	H-0620-51
IC13	Linear opamp, LM308, or eq.	H-0620-103
IC101	Voltage regulator, LM340-15K, or eq.	H-0620-100
IC102	Voltage regulator, LM320-15K, or eq.	H-0620-101
Q1	Transistor, silicon, NPN, type 2N3903	HA-21562
Q2	Transistor, NPN, type D4005	HA-35698
Q3	Transistor, PNP, type D41D5	HA-35699
Q4	Transistor, silicon, NPN, type 2N3903	HA-21562
Q5	Transistor, silicon, PNP, type 2N3905	HA-21564
Q6	Transistor, silicon, NPN, type 2N3903	HA-21562
Q7	Transistor, FET, silicon, type 2N5461	HA-41988

DIAGRAM SYMBOL	NAME OF PART AND DESCRIPTION	RFL PART NO.
RESISTORS		
R1	Resistor, metal-film, 499K, 1%, 1/8W	H-1510-741
R2	Resistor, metal-film, 8.06K, 1%, 1/8W	H-1510-1302
R3	Resistor, metal-film, 2K, 1%, 1/8W	H-1510-1096
R4	Resistor, metal-film, 1.62K, 1%, 1/8W	H-1510-717
R5	Resistor, metal-film, 8.06K, 1%, 1/8W	H-1510-1302
R6	Resistor, fixed, composition, 100K, 5%, 1/4W	H-1009-795
R7	Resistor, metal-film, 100K, 1%, 1/8W	H-1510-737
R8	Resistor, metal-film, 9.09K, 1%, 1/8W	H-1510-483
R9	Resistor, metal-film, 1.0K, 1%, 1/8W	H-1510-486
R10	Resistor, fixed, composition, 10K, 5%, 1/4W	H-1009-742
R11	Resistor, metal-film, 20K, 1%, 1/8W	H-1510-1149
R12	Resistor, metal-film, 10K, 1%, 1/8W	H-1510-775
R13	Resistor, metal-film, 20K, 1%, 1/8W	H-1510-1149
R14	Resistor, metal-film, 20K, 1%, 1/8W	H-1510-1149
R15	Resistor, metal-film, 10K, 1%, 1/8W	H-1510-775
R16	Resistor, fixed, composition, 10K, 5%, 1/4W	H-1009-742
R17	Resistor, metal-film, 3.74K, 1%, 1/8W	H-1510-1325
R18	Resistor, variable, metal-film, 1K, 10%, 1/4W	HA-26533
R19	Resistor, metal-film, 5.62K, 1%, 1/8W	H-1510-1292
R20	Resistor, metal-film, 499 ohms, 1%, 1/8W	H-1510-723
R21	Resistor, fixed, composition, 13K, 5%, 1/4W	H-1009-788

DIAGRAM SYMBOL	NAME OF PART AND DESCRIPTION	RFL PART NO.
R22	Resistor, metal-film, 20K, 1%, 1/8W	H-1510-1149
R23	Resistor, metal-film, 20K, 1%, 1/8W	H-1510-1149
R24	Resistor, fixed, composition, 10K, 5%, 1/4W	H-1009-742
R25	Resistor, metal-film, 20K, 1%, 1/8W	H-1510-1149
R26	Resistor, metal-film, 10K, 1%, 1/8W	H-1510-775
R27	Resistor, metal-film, 20K, 1%, 1/8W	H-1510-1149
R28	Resistor, fixed, composition, 8.2K, 5%, 1/4W	H-1009-814
R29	Resistor, fixed, composition, 51 ohms, 5%, 1/4W	H-1009-818
R30	Resistor, fixed, composition, 2.2K, 5%, 1/4W	H-1009-767
R31	Resistor, fixed, composition, 2.2K, 5%, 1/4W	H-1009-767
R32	Resistor, fixed, composition, 10 ohms, 5%, 1/2W	H-1009-238
R33	Resistor, fixed, composition, 10 ohms, 5%, 1/2W	H-1009-238
R34	Resistor, wirewound, 60 ohms, 1%, 1W	H-1780-100
R35	Resistor, fixed, composition, 24K, 5%, 1/4W	H-1009-790
R36	Resistor, fixed, composition, 13K, 5%, 1/4W	H-1009-788
R37	Resistor, fixed, composition, 13K, 5%, 1/4W	H-1009-788
R38	Resistor, fixed, composition, 13K, 5%, 1/4W	H-1009-788
R39	Resistor, fixed, composition, 13K, 5%, 1/4W	H-1009-788
R40	Resistor, fixed, composition, 13K, 5%, 1/4W	H-1009-788
R41	Resistor, fixed, composition, 13K, 5%, 1/4W	H-1009-788
R42	Resistor, fixed, composition, 3K, 5%, 1/4W	H-1009-765
R43	Resistor, fixed, composition, 820K, 5%, 1/4W	H-1009-868

DIAGRAM SYMBOL	NAME OF PART AND DESCRIPTION	RFL PART NO.
R44	Resistor, metal-film, 5.62K, 1%, 1/8W	H-1510-1292
R45	Resistor, metal-film, 1.0K, 1%, 1/8W	H-1510-486
R46	Resistor, metal-film, 15K, 1%, 1/8W	H-1510-481
R47	Resistor, metal-film, 15K, 1%, 1/8W	H-1510-481
R48	Resistor, metal-film, 15K, 1%, 1/8W	H-1510-481
R49	Resistor, variable, metal-film, 2K, 10%, 1/4W	HA-26484
R50	Resistor, metal-film, 10K, 1%, 1/8W	H-1510-775
R51	Resistor, fixed, composition, 20K, 5%, 1/4W	H-1009-773
R52	Resistor, Metal-film, 12.1K, 1%, 1/8W	H-1510-1387
R53	Resistor, metal-film, 12.1K, 1%, 1/8W	H-1510-1387
R54	Resistor, fixed, composition, 24K, 5%, 1/4W	H-1009-790
R55	Resistor, metal-film, 20K, 1%, 1/8W	H-1510-1149
R56	Resistor, fixed, composition, 10K, 5%, 1/4W	H-1009-742
R57	Resistor, metal-film, 20K, 1%, 1/8W	H-1510-1149
R58	Resistor, metal-film, 10K, 1%, 1/8W	H-1510-775
R59	Resistor, metal-film, 13K, 1%, 1/8W	H-1510-778
R60	Resistor, metal-film, 5.62K, 1%, 1/8W	H-1510-1292
R61	Resistor, metal-film, 499K, 1%, 1/8W	H-1510-741
R62	Resistor, metal-film, 6.81K, 1%, 1/8W	H-1510-1281
R63	Resistor, variable, metal-film, 10K, 10%, 1/4W	HA-25403
R64	Resistor, metal-film, 6.81K, 1%, 1/8W	H-1510-1281
R65	Resistor, fixed, composition, 5.1K, 5%, 1/4W	H-1009-872

DIAGRAM SYMBOL	NAME OF PART AND DESCRIPTION	RFL PART NO.
R66	Resistor, metal-film, 15K, 1%, 1/8W	H-1510-481
R67	Resistor, fixed, composition, 470 ohms, 5%, 1/4W	H-1009-751
R68	Resistor, metal-film, 20K, 1%, 1/8W	H-1510-1149
R69	Resistor, metal-film, 590 ohms, 1%, 1/8W	H-1510-1378
R70	Resistor, fixed, composition, 5.1K, 5%, 1/4W	H-1009-872
R71	Resistor, metal-film, 100K, 1%, 1/8W	H-1510-737
R72	Resistor, metal-film, 1.21K, 1%, 1/8W	H-1510-1332
R73	Resistor, metal-film, 634 ohms, 1%, 1/8W	H-1510-1502
R74	Resistor, metal-film, 499K, 1%, 1/8W	H-1510-741
R75	Resistor, metal-film, 20K, 1%, 1/8W	H-1510-1149
R76	Resistor, metal-film, 750 ohms, 1%, 1/8W	H-1510-742
R77	Resistor, metal-film, precision, 10K, 1%, 1/8W	H-1510-486
R78	Resistor, metal-film, 5.62K, 1%, 1/8W	H-1510-1292
R79	Resistor, metal-film, 5.62K, 1%, 1/8W	H-1510-1292
R80	Resistor, fixed, composition, 470 ohms, 5%, 1/4W	H-1009-751
R81	Resistor, metal-film, 3.01K, 1%, 1/8W	H-1510-711
R82	Resistor, metal-film, 10K, 1%, 1/8W	H-1510-775
R83	Resistor, variable, wirewound, 10K, 5%, 2W	HA-41992
R84	Resistor, variable, composition, 100 ohms, 10 turns	HA-30752
R85	Resistor, wirewound, 1K, 5%, 2W	HA-27422
R86	Resistor, variable, cermet, 1K	HA-41989
R87	Resistor, metal-film, variable, 200 ohms, 10%, 3/4W	HA-26486

DIAGRAM SYMBOL	NAME OF PART AND DESCRIPTION	RFL PART NO.
R212	Resistor, wirewound, 1.5 ohm, 1%, 1/8W	H-1780-56
R213	Resistor, metal-film, 1K, 1%, 1/8W	H-1510-486
R214	Resistor, metal-film, 9.53K, 1%, 1/8W	H-1510-779
S204	Switch, toggle, SPDT	HA-41987
T201	Transformer, attenuator	HA-41993
COMPONENTS OF DIGITAL ATTENUATOR		
C301	Capacitor, ceramic disc, 0.1 μ F, -20 +80%, 500V	H-1007-201
C302	Capacitor, ceramic disc, 0.1 μ F, -20 +80%, 500V	H-1007-201
C303	Capacitor, ceramic disc, 0.1 μ F, -20 +80%, 500V	H-1007-201
C304	Capacitor, ceramic, 0.47 μ F, -20 +80%, 50V	H-1007-939
C305	Capacitor, ceramic, 0.47 μ F, -20 +80%, 50V	H-1007-939
C306	Capacitor, dipped mica, 51pF, 5%, 500V	HA-16516
C307	Capacitor, mica, 91pF, 5%, 500V	HA-16521
C308	Capacitor, tantalum, 15 μ F, 20%, 20V	H-1007-716
CR301	Diode, silicon, 1N914B	HA-26482
CR302	Diode, silicon, 1N914B	HA-26482
CR303	Diode, silicon, 1N458A	HA-41978
CR304	Diode, silicon, 1N458A	HA-41978
IC301	Opamp, LM308, or eq.	H-0620-103
IC302	Opamp, HA2-2605-5	H-0620-102
R301	Resistor, fixed, composition, 470 ohms, 5%, 1/4W	H-1009-751
R302	Resistor, fixed, composition, 9.09K, 1%, 1/8W	H-1510-483

DIAGRAM SYMBOL	NAME OF PART AND DESCRIPTION	RFL PART NO.
R303	Resistor, metal-film, 1.0K, 1%, 1/8W	H-1510-486
R304	Resistor, metal-film, 95.3K, 1%, 1/8W	H-1510-1574
R305	Resistor, metal-film, 9.53K, 1%, 1/8W	H-1510-779
R306	Resistor, metal-film, 953 ohms, 1%, 1/8W	H-1510-1511
R307	Resistor, fixed, composition, 10K, 5%, 1/4W	H-1009-742
R308	Resistor, fixed, composition, 47K, 5%, 1/4W	H-1009-792
R309	Resistor, wirewound, 3 ohms, 0.05%, 1/8W	H-1780-109
R310	Resistor, wirewound, 1.5 ohm, 1%, 1/8W	H-1780-56
R311	Not used	
R312	Resistor, metal-film, 49.9 ohms, 1%, 1/8W	H-1510-738
R313	Resistor, variable, metal-film, 1K, 40%, 3/4W	HA-26533
R314	Resistor, variable, metal-film, 10K, 10%, 3/4W	HA-25403
R315	Resistor, metal-film, 1K, 10%, 3/4W	HA-26533
R316	Resistor, variable, metal-film, 100 ohms, 10%, 3/4W	HA-26485
R317	Resistor, metal-film, 1.0K, 1%, 1/8W	H-1510-486
T301	Transformer, attenuator	~~HA~~ HA-41993
	Mating plug and harness for field installation of BCD output	HB-43775
	Mating plug for rear panel jack	HB-43774
	Schematic, Analog Attenuator	HD-42475
	Schematic, Digital Attenuator	HD-42476
	Schematic, Main Circuit	HE-42474

~~P/N~~ P/N is outdated. New P/N 45345

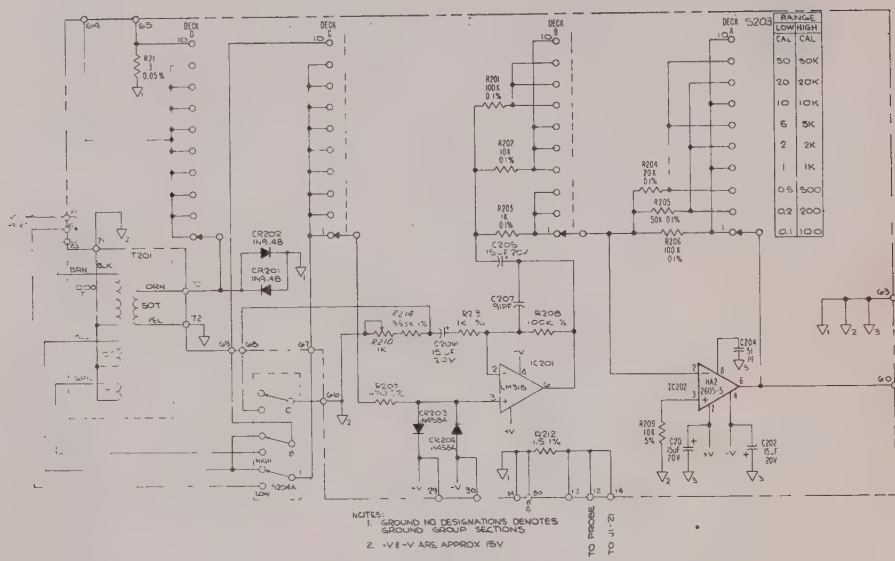


Figure 2. Schematic of Input Attenuator, Model 750A.

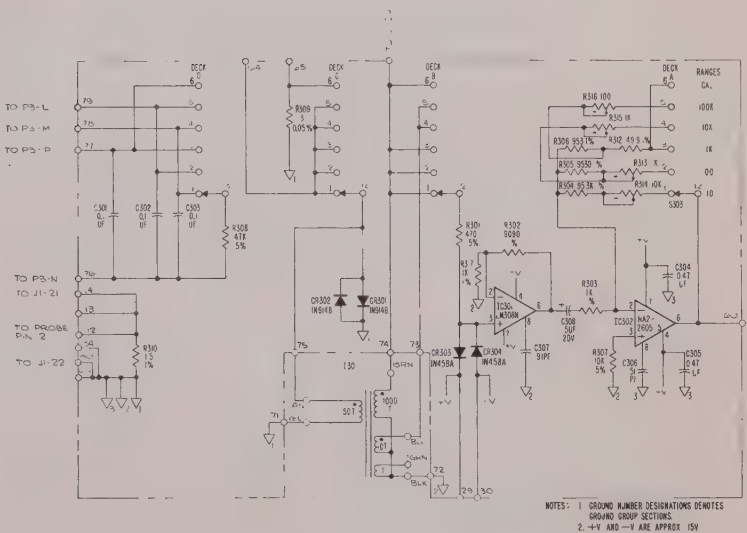


Figure 3. Schematic of Input Attenuator, Model 750D.



Warranty

The Models 750A and 750D Gaussmeters carry a warranty of 12 months from date of delivery for replacement of any part, except probe(s), which fails during normal operation or service. A deficient part should be returned to the factory, shipping charges prepaid, for replacement f.o.b. Boonton, N. J.

RFL Industries, Inc.

Boonton, New Jersey, U. S. A.



RFL Industries, Inc.

INSTRUMENTATION DIVISION • Boonton, New Jersey 07005

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